

High Efficiency Quantum Dot III-V Multijunction Solar Cell for Space Power, Phase I

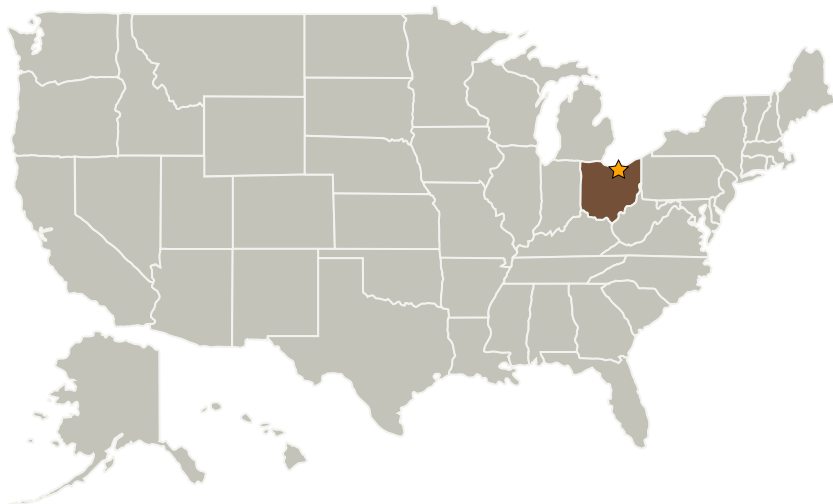
Completed Technology Project (2004 - 2004)



Project Introduction

Quantum dots are nanoscale materials that have already improved the performance of optical sensors, lasers, and light emitting diodes. The unique properties of these nanomaterials offer tremendous benefit in developing high-efficiency photovoltaic solar cells as well. Theoretical studies predict a potential efficiency of 63.2 %, for an array of quantum dots sandwiched between the p and n-type layers in a typical photovoltaic junction. This would yield an increase in efficiency of a factor of 2 over any state-of-the-art (SOA) devices available today. We are proposing to utilize quantum dots to develop a super high-efficiency multijunction III-V solar cell for space. In metamorphic triple junction space solar cells, pioneered by Essential Research, Inc., the InGaAs junction or bottom cell of the three-cell stack is the current limiting entity. We propose an InGaAs cell which incorporates InAs quantum dots to provide sub-gap absorption and thus improve the short-circuit current. This cell could then be integrated into a conventional three-cell stack to achieve a space solar cell whose efficiency would dramatically exceed current SOA standards. A theoretical estimate predicts that a InGaIP(1.95 eV)/InGaAsP(1.35 eV)/InGaAs(1.2 eV) triple junction cell incorporating quantum dots to improve the bottom cell current would have an efficiency exceeding 40%.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Essential Research, Inc.	Supporting Organization	Industry	Cleveland, Ohio

Primary U.S. Work Locations

Ohio

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Samar Sinharoy

Technology Areas

Primary:

- TX10 Autonomous Systems
 - └ TX10.4 Engineering and Integrity
 - └ TX10.4.5 Architecture and Design of Autonomous Systems